**Introduction:** In Europe, the prevalence of overweight and obesity in adults has tripled in the last two decades. This trend is also observed in children and adolescents, having the countries of southern Europe a higher prevalence of overweight compared with other countries in Europe.

However, the inexistence of an international consensus about how to measure overweight and obesity makes the comparison of cross-sectional prevalence data difficult, as well the clear identification of its trends.

Overweight and obese adolescents have high morbidity than non-overweight adolescents, with insulin resistance and impaired insulin secretion being the most common pathologies associated to overweight.

**Objectives:** This research aimed to study the anthropometric measures that can contribute to the evaluation of overweight and obesity, and the role of these measures identifying adolescents with alterations on the glucose metabolism through the following specific objectives:

1) to evaluate the ability of different body fat measures to identify overweight and obesity in 13-year-old adolescents and to identify the best cut-offs of these measures;
2) to evaluate the ability of different adiposity measures to identify 13 year old adolescents with high values of glucose, insulin and HOMA.

**Methods:** Eligible participants were urban adolescents, members of the Epidemiological Health Investigation of Teenagers in Porto (EPITeen). The EPITeen is a population-based cohort of adolescents born in 1990, which were recruited from private or public schools in Porto in the 2003/2004 school year (78% participation at the individual level). Data were collected using self-administered questionnaires, comprising information on clinical, behavioural, social and demographic characteristics. A physical examination was also performed at school, by a team of experienced nurses, nutritionists and physicians. Beyond weight and height, waist circumference and bicipital and tricipital skinfolds thickness were measured. A 12-hour overnight intravenous blood sample was taken from an antecubital vein. Blood glucose was measured using automatic standard routine enzymatic methods and insulin was measured by radioimmunoassay. Insulin resistance was assessed by the homeostasis model method (HOMA-IR), based on fasting glucose and insulin concentrations: HOMA-IR=Insulin (mU/ml)*glucose (mmol/L)/22.5. To compare means we used the Wilcoxon-Mann-Whitney and to examine relations between the different anthropometric measurements with BMI, and the relations between the anthropometric measures and glucose, insulin and HOMA we used Spearman correlation coefficient. The diagnostic
value of the different measures of adiposity was calculated through the receiver-operating characteristic (ROC) curve analyses. The area under the curve (AUC) is also presented.

**Results:** In our sample the prevalence of overweight (BMI≥85th) was 11.9% in boys and 12.4% among girls.

BMI was positively and significantly correlated with all anthropometric measures, in both genders. In boys the stronger association was found with waist circumference, both in adolescents with BMI<85th and ≥85th. In girls, the stronger association was found with body fat percentage for those with BMI<85th [0.79(95% CI: 0.77; 0.82)] and with waist circumference among those with BMI≥85th [0.71(95% CI: 0.59; 0.80)]. Waist circumference, using the 75th percentile as cut-off, was the anthropometric measure that better identified adolescents with BMI≥85th percentile. Sensitivity was 100% in boys and 97.6% (95% CI: 94.9-100) in girls; specificity was 85.5% (95% CI: 83.1-87.9) and 85.8% (95% CI: 83.5-88.1). When the waist to height ratio was used those values were 86.7% (95% CI: 80.5-93.0); 86.3% (95% CI: 80.2-92.3) for sensibility, and 92.9% (95% CI: 91.2-94.7); 94.8% (95% CI: 93.3-96.2) for specificity.

In both sexes all of the anthropometric measurements correlate positively and significantly with insulin and HOMA. Among girls, the best anthropometric measure to identify adolescents with values of insulin and HOMA above the 75th percentile was waist to height ratio: sensitivity was 66.7% (95% CI:59.4-73.9) for insulin and 60.2% (95% CI:52.7-67.8) for HOMA; specificity was 59.2% (95% CI:54.8-63.6) and 60.7% (95% CI:56.4-65.1), respectively. Among boys the best anthropometric measure to identify those above the 75th percentile was BMI: Sensitivity was 66.4% (95% CI:58.9-74.0) for insulin and 65.6% (95% CI:58.0-73.1) for HOMA; specificity was 62.5% (95% CI:58.1-67.0) and 62.2 (95% CI:57.7-66.6), respectively.

**Conclusions:** Beyond BMI, waist circumference demonstrated to be a sensitive and specific tool for the detection of overweight in adolescents. Additionally, the use of the waist to height ratio may improve the specificity of this measure.

Furthermore, BMI, waist circumference and waist circumference to height ratio revealed to be accurate in the identification of adolescents at risk of alterations in the glucose metabolism.